REMARKS

I. Claims 143-160 are allowed.

Applicant respectfully thanks the Examiner for indicating that these claims are allowed.

II. Claim Rejections Under 35 U.S.C. §103.

Claims 1, 4, 8-14, 17, 21-28, 30,46-47, 54-59, 62, 66-72, 75, 79-84, 113 –114 stand rejected under 35 U.S.C. 103(a) as being obvious over Jackson in view of Yamaguchi et al (Phase-shifting digital holography) and further in view of Rentzepis et al (U.S.5,325,324).

In order to reject claims 1, 4, 8, 14, 17, 21, 59, 62, 66, 72, 75, 79, the USPTO respectfully cites again the patent by Jackson, the paper by Yamaguchi and a patent by Rentzepis '324 in combination.

Claim 1

Claim 1 has been amended and reads:

1. (Currently amended) A method of encrypting a set of data, the method comprising:

generating an original set of data regarding a **3D input scene with multiple perspectives**;

generating a reference set of data;

encoding the reference set of data; and

combining the original set of data with the encoded reference set of data to generate an encrypted set of data;

wherein the encoding of the reference set of data comprises phase encoding the reference set of data; and

wherein the phase encoding of the reference set of data comprises introducing a random phase into the reference set of data[[.]] ;and

further comprising recording the encrypted set of data **in a digital hologram.**

The amendment includes the limitations from claims 9 and 10 and the language "generating an original set of data regarding a 3D input scene with multiple perspectives;" which is supported at least by Figure 1 where it is shown that a 3D object 32 is recorded from

different 3D perspectives using diaphragms 116 and 118 which open alternatively (see also page 9 of the specification at top for support).

JACKSON – No 3D input scene

In contrast, Jackson does not make any reference to a 3D input scene with multiple perspectives. **In fact, the Jackson patent makes reference always to an electro-optical device that converts electronic data into a 2D data.** This 2D data is then processed and encrypted.

Thus, Jackson always uses a CCD camera or a similar recording device to input the original data to the encryption system. This means that he records the encrypted information of a 2D image and he recovers a 2D image after decryption. Thus, he can not focus to different planes (for example different depth planes, i.e., in front of the object, in back of the object, etc.) or obtain different perspectives of the input images (to the left side or right side or above or below etc. of the object) because he does not have the input data to do so from a flat 2D recorded scene.

However, the present claims record a 3D hologram that has this kind of information, i.e., a 3D input scene with multiple perspectives. Thus, claims 1 encrypts a 3D input scene as a digital hologram. This means that, after decryption, 3D information can be recovered.

Thus, different views or images of the original 3D input information can be recovered, by focusing to different planes, and also different perspectives of the 3D input information, by using different regions of the digital hologram.

Thus, it should be clear that the random phase mask is for encryption only. Thus, once we have decrypted the information with the proper key, we do not need any other phase mask to recover the information at different locations of the 3D original input scene.

RENTZEPIS – ONLY 2D input also and no encryption

Also, it is noted that claim 1 claims a method of "encryption" *per se*. Yamaguchi as has nothing to do with encryption. Jackson deals with encryption, but only for 2D images.

Rentzepis uses a random phase mask for storing 2D images in a holographic 3D medium, **but not for encryption**. Specifically, Rentzepis wants to make an image of an input

2D plane into different planes along a 3D medium (see Fig. 8 in sheet 4 in Rentzepis). To this end, he makes a collection of holographic lenses with different focal length and he records them altogether in the same hologram (device denoted hologram in Fig. 8). To activate only one lens, and not the others, they are multiplexed. Each holographic lens is recorded in the hologram by using a different phase mask to encode the reference beam. In this way, he can activate a particular lens by illuminating the hologram with a beam encoded with the corresponding random phase mask. So, phase masks are used as a kind of lens selection procedure to save the information (which is not encrypted, it is just an image of the input data) in different planes of the final recording medium. In other words, phase masks are used to make control of a kind of dynamic focusing lens stored in the hologram. This is explained in Figs. 7 and 8 and in column 12 lines 16 to 24, and also in column 27 lines 4 to 9 in Rentzepis et al. patent. **Thus, it is important to emphasize that Rentzepis records 2D information, without encryption and in an analog 3D medium (not a digital hologram).**

Yamaguchi – no encryption or random phase encoding of a 3D input scene with multiple perspectives.

Yamaguchi uses a digital holography system only to record 3D images of the input data. However, a comparison of present Figure 1 to Fig. 1 of Yamaguchi shows that present diaphragms 122 and 124 are not present so that different perspectives of the 3D object or input scene are not recorded as data in Yamaguchi.

Also, Yamaguchi does not try to use random phase encoding (or try to hide or to encrypt information). Rather, as explained in our previous response to the USTPO Office, Yamaguchi uses only 4 well determined phase shifts, each one applied over the whole reference beam, to get a constant phase shift and to apply a phase shifting algorithm. He does not apply different unknown or "random phase" values to the reference set of data or do any encryption.

The traverse

Because claim 1 is amended to include the limitations from claims 9 and 10 as well as the "generating an original set of data regarding a **3D input scene with multiple perspectives**;" added limitations, the rejections of claims 9 and 10 are the outstanding rejections to be addressed; they are found on page 3 bottom to page 4 top of the Office Action.

However, as discussed above, none of the references taken alone or together teach or suggest a random phase encryption method as claimed in Claim 1 comprising:

a. "generating an original set of data regarding a **3D input scene with multiple perspectives**;"

b. further comprising recording the encrypted set of data in a **digital hologram.**

Thus, Claim 1 is allowable because the required *prima facie* case of obviousness had not been established as required by 35 USC §103 (see MPEP 706.02(j)).

Independent claims 14, 59, and 72 have been amended similarly and are allowable for the same reasons as claim 1. The claims dependent there from are also allowable.

In regard to claim 4

At page 3 of the Office Action, the USPTO respectfully notes that Jackson does not discuss the encoding of data by use a random phase by using the equation as claimed in claim 4 of:

$$U_R(x,y;\Delta\varphi_p) = A_R(x,y)\exp\left[i\left(\varphi_R(x,y) + \Delta\varphi_p\right)\right]$$

However, the USPTO alleges that Yamaguchi uses such a random phase equation at page 1268 and also that Rentzepis uses random phase encoding (col. 18, lines 29-42).

However, Yamaguchi does not use any random phase encoding (at the reference beam or at the object beam) **so there is no such equation in his paper** (**his paper is not about random phase encoding). The equation at page 1268 of Yamaguchi are only for a parabolic approximation at (1) and the other equations are not similar (2) and (3).**

Specifically, Yamaguchi uses a digital holography system only to record images of the input data. His idea can be applied, for example, in microscopy. However, he does not try to use random phase encoding (or try to hide or to encrypt information).

Rather, as explained in our previous response to the USTPO Office, Yamaguchi uses only 4 well determined phase shifts, each one applied over the whole reference beam, to get a constant phase shift and to apply a phase shifting algorithm. He does not apply different unknown or "random phase" values to the reference set of data or do any encryption.

Thus, Yamaguchi does not teach or suggest the claimed equation of claim 4 as the USPTO argues. Thus, the USPTO's reasoning at page 3 is respectfully incorrect where it is argued that it would be obvious to use Yamaguchi's equation in the system of Jackson. Therefore, the rejection of claim 4 is traversed.

In regard to claim 10

The USPTO argues that at page 3 that motivation to combine Jackson, Yamaguchi, and Rentzepis would have been to reconstruct a cross section with high image quality because random phase encoding is highly accurate. However, neither of the papers or patent, pretends to have 2D sectioning of a 3D input space by means of a random phase mask. :

- Jackson encrypts only 2D input information recorded by a CCD camera with a random phase mask.

- *Rentzepis* uses a random phase mask to select a multiplexed holographic lens which images a 2D object into a 3D analog holographic volume.

Claims 9-10, 22-23, 46-47, 57-58, 80-81.

In the rejection at page 3 (bottom) regarding claims 9-10, 22-23, 46-47, 57-58, 80-81, the USPTO argues that the Examiner's proposed modified system of Jackson, Yamaguchi, and Rentzepis discloses recording a hologram as claimed (see Jackson column 11 lines 10-28).

Specifically, with respect to claims 12-13, 25-26, 70-71, 83-84, the USPTO argues that they discloses the original and reference set of data comprises an optical image, a digitized image, a one dimensional set of data, a two dimensional set of data, **a multi-dimensional set of data,** an electrical signal or an optical signal (see Jackson column 11 lines 10-28).

Applicants do not agree with the rejection of the second series of claims like claim 12 because Jackson does not make any reference to 3D optical data or multidimensional input data. **In fact, the Jackson patent makes reference always to an electro-optical device that converts electronic data into a 2D optical image.** This image is then processed and encrypted.

Thus all of the claims are respectfully asserted to be allowable.

A note about Ladino

With respect Ladino, of course there are many papers and patents about compression but not about compression of digital holograms. And compression of holograms has many other problems that should be taken into account. In this direction, *Yamaguchi* or *Rentzepis* do not talk about compression and *Jackson* talks about it but he is not going to reconstruct 3D information from the decompressed digital hologram. It is important to note that to compress a digital hologram is not an obvious task. You can loose quality on a conventional image by compression if you are going to look at it directly. However, if you do so with a digital hologram you need to be very careful because you need to recover the original information by applying numerical or optical operations on the compressed hologram.

III. Conclusion

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance of all of the claims is respectfully requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Please telephone the undersigned for any reason. Applicants seek to cooperate with the Examiner and to expedite prosecution.

Respectfully submitted,

By

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Note "s signature" used above, see MPEP 302.10

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